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ABSTRACT

The Cooperative Electronics Program was developed through the joint efforts of Linn-Benton Community College (LBCC), West Albany High, and Lebanon High, all of which are in the Linn-Benton Education Service District serving Albany, Oregon. The project, which was undertaken in the spring of 1988, is intended to result in a program whereby high school electronics students can receive advanced placement credits for work completed toward an Associate of Science degree in electronics technology at LBCC. Since the project's inception, the first course in the LBCC electronics program has been redesigned. This program description represents a sample of the work completed for the cooperative electronics program. The following materials are included: a statement of the program goals, course guidelines, an outline of the major objectives addressed in the program's course in the fundamentals of electronics, an outline of the course's six units, general laboratory report directions and a report outline, a student activity on balanced bridges, terminology for unit 1, and the unit test for unit 1. (MN)

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Linn-Benton Regional Vocational Program
Cooperative Electronics Program Credit

The following pages represent a sample of the work completed for the Cooperative Electronics Program. This program consists of a joint effort by Linn-Benton Community College, West Albany High and Lebanon High. Our goal is to design a program whereby high school electronics students can receive advanced placement credits for work completed towards the A.S. degree in Electronics Technology at L.B.C.C.

Work on the project began in the Spring of 1988 and resulted in the redesign of the first course in the L.B.C.C. Electronics program. This new course will be called Fundamentals of Electronics and will be worth four quarter hours of credit.

The materials developed will allow a high school electronics student to work through the materials contained in this new course before entering the college. The student will complete a series of fourteen lab activities, pass exams in each of the six units of study, score at least 70% on a comprehensive final exam, and finally present a sample notebook to a Linn-Benton instructor for approval.

A study guide is also included in the packet that can be used by the student to prepare and review for the final exam. This study guide and exam can also be used as a placement tool by the college. Entering students with job related, military, or other educational background in electronics can be evaluated with this system. This should provide prospective students with an additional incentive to begin the program.

Attached is a description of the program with a detail of all laboratory activities. Included is a sample lab, test, and worksheets. All labs and tests are to be tested in the two high schools this winter (88-89) and a final draft will be submitted to Wayne Johnson after this testing is completed.

COOPERATIVE ELECTRONICS PROGRAM

This program enables a high school student to obtain Linn-Benton Electronics program credits for work completed within his/her school. It is important that any student participating in this program achieve a level of competence equal to that of a regular college student. These materials will insure that certain basic competencies are met.

It is suggested that a student will have already completed a basic electronics course at the High School level before attempting this course. The materials are designed to be self paced. Cooperating teachers are encouraged to supplement these materials with their own to provide a well rounded program.

Upon successful completion of this program, the student will receive 4 credits at Linn-Benton Community College. This will be a direct replacement for the Electronics course Fundamentals of Electronics.

COURSE GUIDELINES

This course consists of a laboratory based learning program with specific activities, tests and homework problems. Before progressing to the next unit, a student must pass the unit exam with a score of 70% or better. Upon successful completion of the entire program, the student will meet with a Linn-Benton instructor and present a note book of selected lab reports. These reports can be any four of the last six labs completed in the program. All must meet normal college standards.

I. Begin unit I
   - A. Reading and homework questions.
     1. Any supplemental materials.
   - B. Lab activities.
     1. A written report must accompany each lab activity.
   - C. Unit exam

II. Progress through all six units of study.

III. Final Exam
   - A. The final exam will consist of a comprehensive test of material covered throughout the course.

IV. Presentation of materials.
   - A. Student will meet with L.B.C.C. instructor to present his/her lab notebook for approval. This lab notebook will consist of any four lab of the last six labs completed.

FUNDAMENTALS OF ELECTRONICS

I. The student will research, define terms and solve problems related to:

A. D.C. fundamentals.

B. Field storage

C. A.C. fundamentals

II. The student will be able to apply Electronic laws and theories to solve the following types of problems:

A. D.C. Resistive Circuits

1. Series circuits

2. Parallel circuits

3. Series-Parallel circuits

4. RC circuits

B. A.C. Circuits

1. Waveform analysis

2. RC circuits

3. LR circuits

III. The student will demonstrate proficiency with the following activities and equipment in the lab:

A. Equipment

1. VOMs

2. DMMs

3. Power supplies

4. Breadboards and circuit construction

5. Oscilloscopes

B. Activities

1. Successful completion of all lab activities, including a written report for each activity.

COURSE OUTLINE
FUNDAMENTALS OF ELECTRONICS

Each unit of study includes the following:

1. Suggested reading assignments
2. Suggested homework
3. Supplemental written assignments
4. Lab Activities as shown below
5. Unit Exam

UNIT	TOPIC	LAB
I	D.C. Fundamentals	I. Resistance II. Continuity
II	Simple D.C. Circuits	III. Series Circuits IV. Switches V. Ground References VI. Parallel Circuits
III	Complex D.C. Circuits	VII. Voltage and Current Dividers VIII. Series Parallel IX. Resistive Bridges and Transducers
IV.	Meters	X. Ammeters XI. Voltmeters XII. Voltmeter Loading XIII. Ohmmeters XIV. A.C. Voltmeters
V.	A.C. Fundamentals and Waveform Analysis	XV. Oscilloscope Basics XVI. Oscilloscope Use and Measurement XVII. Capacitor testing and RC Circuits
VI.	Time Constants	XVIII RC Time Constants XIX. LR Time Constants

GENERAL LAB REPORT DIRECTIONS

Each lab report must follow a specific outline. The written report is a basis for grading a students progress through the lab activity. It should be up to the standards set by the Community College. Certain general guidelines to follow are:

1. All reports must be written using the Lab Report Outline that accompanies this report.

2. Correct spelling, punctuation and grammar are to be used at all times. Do not use fragmented or run on sentences. Each report will be graded based on the information as well as the quality of writing.

3. All tables, drawings, and charts must be labeled. The report should be able to stand alone; the reader should be able to read and interpret the data in the report without referring to the lab itself.

4. Show calculations. When using equivalent circuits, show all work and label each drawing. Show the step-by-step calculations.

LAB REPORT OUTLINE

Your lab reports must follow the outline presented here.

NAME

Title of Lab

A. PURPOSE

State the purpose of the lab. This should be one sentence.

B. MATERIALS AND EQUIPMENT

List the materials and equipment used in the lab.

C. PROCEDURE

This is a brief statement of the steps taken in the lab activity. In a few sentences, state the procedure used in the lab. DO NOT list each step of the lab here. Just give a brief summary of the steps.

1. State the test procedures.

2. Draw and label any diagrams needed for the lab.

3. Make a table of data collected during the lab testing. This is an important step! Be sure your table is well marked and readable.

C. CONCLUSION

This is the most important part of the lab report! DESCRIBE what happened in the lab. EXPLAIN how the circuits worked and what your data means. DO NOT just give a recap of the procedure! THINK about what you have done and try to relate the test results to known theory, or present your own theories based on your testing. If your experiment did not work properly try to explain what could have gone wrong. THE BEST GRADE ON A LAB REPORT WILL BE GIVEN TO THE STUDENTS WHO DEVELOP AND PRESENT THEIR OWN THEORIES BASED OF THEIR TESTING IN THE LAB.

BALANCED BRIDGES

PURPOSE

The purpose of this lab is to study the function of a balanced bridge circuit.

MATERIALS

Resistors: 330, 1K, 2.2K, 10K, 25K potentiometer
2-diodes, LED, LM 339

PROCEDURE

I. Resistive Bridges

A. Look at the circuit in fig. 1. If the bridge is in the balanced condition, there will be no current flow through RL. If RL is replaced by a sensitive current meter (like a galvanometer), it will register any unbalanced condition. In the following tests, remember that if there is no voltage drop across a resistor, there is no current flowing through it.

1. Calculate the voltage at point A.

2. Calculate the voltage at point B if R4=10K

3. Is the bridge balanced? If not, calculate the value that would balance the bridge.

R4=_____

4. Adjust the potentiometer to that value and place it in the circuit. Verify that you now have a balanced bridge by measuring voltage at A and B.

A=_____

B=_____

II. Bridge circuit applications

A. Bridges are often used in instrumentation and transducer measurement situations. The circuit in fig. 2 is used as a temperature sensor. The I.C. is an operational amplifier used as a voltage comparator. It senses the difference in voltage between it's two inputs.

1. Build the circuit in fig. 2.

2. Turn the potentiometer and watch the LED. It should turn on and off depending on the position of the pot. Adjust the pot until the LED just turns off.

3. Touch a soldering iron to D1 and watch the circuit operation.

4. Remove the iron and watch the LED as the diode cools.

5. See how you can adjust the sensitivity of the sensor with the pot. Could you set it to respond to a specific temperature?

III. Resistor power rating tester.

A. Using the same 9 volt supply that supplies your tester circuit, determine the resistor value that will dissipate it's rated power value when connected to the supply. Use this as a heat reference and adjust the sensor to respond to that specific heat.

R= _____Ohms _____Watts

B. Check the calibration by connecting a resistor that dissipates one half (1/2) of it's rated power value.

R= _____Ohms _____Watts

** In your lab report be sure to answer the following:

a. How much current flows through a load connected to a balanced bridge?

b. Describe in detail how to calculate R4 for a balanced condition in the bridge circuit below.

c. What value of 1/4 Watt resistor will dissipate 1/8 watt when connected to a 10 volt source?

d. Describe what effect heat has on a diode.

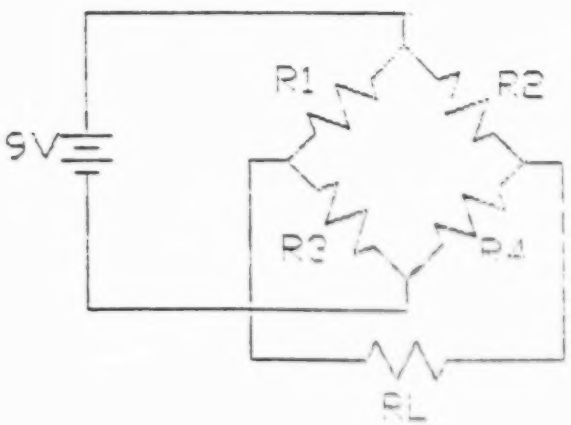

FIG 1

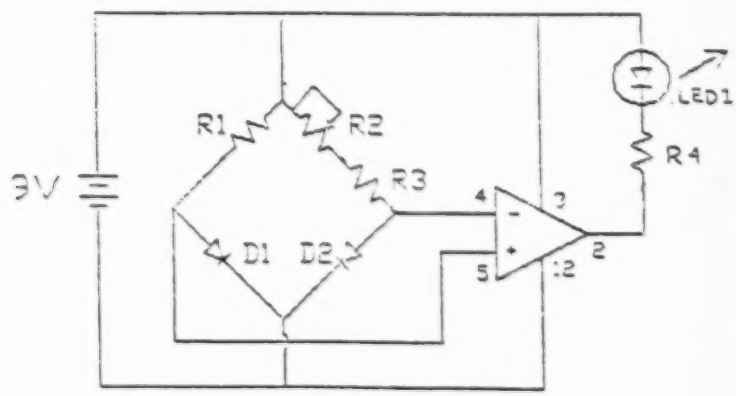

Fig 2

R1= 330
R2= 1K
R3= 2.2K
R4= ?
RL= 10K

R1= 10K
R2= 50K POT
R3= 1K
R4= 330
LED1= LED
D1, D2= SILICON DIODES
IC1= LM339

TERMINOLOGY
UNIT I

Turn in along with Lab I.

Use your reference or text book to find each of these terms. Give a complete definition in your own words.

1. Nucleus

2. Shells

3. Neutrons

4. Protons

5. Valence

6. Molecule

7. Atomic Bond

8. Ion

9. Ionic Bond

10. Covalent Bond

11. Free Electron

12. Metallic Bonding

13. Conductor

14. Dialectric

15. Insulator

16. Semiconductor

17. Work

18. Force

TERMINOLOGY
UNIT I

Turn in along with Lab II.

Use your reference or text book to find each of these terms. Give a complete definition in your own words.

1. Coulomb

2. Coulomb's Law

3. Ampere

4. Voltage, EMF

5. Voltaic Cell

6. Voltaic Pile

7. Electrode

8. Electrolyte

9. Joules

10. Volt

11. Resistance

12. Conductance

13. Ohm

14. Sieman

15. Temperature Coefficient

16. Newton

17. Electron volt (eV)

18. Power

19. Watt

20. Watts/horsepower

21. Kilowatthour

22. Efficiency

TEST UNIT IA

PART I

A. List the colors for the following resistor values:

1. 1.5M 5% _____

2. 22K 10% _____

3. 150K 20% _____

4. 120 5% _____

5. 2.2 5% _____

6. 0.5 5% _____

B. Write the value in proper metric form for the following resistors:

7. Brown-Red-Black-Gold ----------

8. Red-Blue-Orange-Silver ----------

9. Green-Black-Black-Gold ----------

10. Orange-Orange-Red ----------

11. Yellow-Violet-Brown-Gold ----------

12. Gray-Red-Gold-Gold ----------

PART II

Use the following terms to fill in the letter of the answers below:

a. Nucleus	f. Force
b. Work	g. Shell
c. Proton	h. Ion
d. Molecule	i. Semicondictor

13. A material that conducts well only under certain conditions is called a -----

14. When an object is moved a measurable distance what has been accomplished? -----

15. To move an object, one must apply a -----

16. An atom that lost an electron is called -----

17. Electrons orbit their nucleus in a -----

18. The atomic partical with a positive charge is -----

TEST UNIT IB

PART I

Use the following terms to fill in the letter of the answers below:

a. Current	f. Semiconductor	k. Resistance
b. Insulator	g. Siemem	l. Efficiency
c. Amperes	h. Ohm	m. Watt
d. Free Electron	i. Power	n. Valence
e. Conductor	j. Voltage	o. Conductance

1. The inverse of resistance is _____

2. Current is measured in _____

3. Movement of electrons per unit time is the definition for _____

4. Materials with electrons tightly bound to their atoms are called _____

5. EMF is another term used for _____

6. Conductance is measured in the _____

7. An opposition to current is _____

8. A negative charge broken from it's Valence shell is called _____

9. A ratio of output to input is called _____

10. A material that allows free current flow is a _____

PART II

Answer the following:

11. A light bulb is 35% effecient as a light source. With an output of 20 joules, what is it's input?

---

12. A transformer has an input of 150 Watts and an output of 140 Watts. What is it's efficiency?

---

13. An ohmmeter is placed in (series, parallel) with the device being tested.

---

14. A device with good continuity will have (low, high) resistance.